PROPOSED INITIAL 5-YEAR GROUNDWATER CLEANUP APPROACH
RIALTO-COLTON AND NEIGHBORING BASINS
SAN BERNARDINO COUNTY, CALIFORNIA

1 INTRODUCTION

Groundwater is the principal source of water for residents of southwestern San Bernardino County, California. Together, the Cities of Rialto and Colton, Fontana Water Company (FWC), and West Valley Water District (WVWD) (the purveyors) provide water to more than 235,000 consumers. Much of the water that is served by these purveyors comes from the Rialto-Colton groundwater basin (RCB) and adjoining portions of the neighboring basins (collectively referred to herein as "the basins") (**Figure 1**). Since 1997 when water purveyors in the region first began testing municipal production wells for perchlorate, the anion has been detected in numerous wells at concentrations that exceed the state notification level for drinking water. In response to detections of perchlorate, water purveyors were compelled to shut down more than 20 production wells in the region and/or put treatment on wells, thus significantly impacting the ability of purveyors to provide a stable and reliable source of water to the community.

Recognizing these conditions, the City of Colton, City of Rialto, County of San Bernardino (the County), FWC and the WVWD formed the RCB Technical Committee (RCBTC) to collect the data needed to develop and initiate an appropriate strategy to cleanup groundwater. The goals of this strategy are to restore groundwater supplies to the four water purveyors and to accelerate groundwater cleanup. Working with the County of San Bernardino, the purveyors have agreed on a proactive approach that protects and begins to restore the public water supply, implements interception and treatment of groundwater contaminants, optimizes limited resources, and decreases the timeframe and overall costs required for cleanup of groundwater. This document identifies the groundwater cleanup approach that the RCBTC has developed to address perchlorate contamination.

2 PERCHLORATE IMPACTS/SOURCES

Figure 2 depicts the distribution of perchlorate-impacted water production wells within the service areas of the purveyors. Groundwater investigations indicate that there are likely numerous sources of contamination in the area, with two generalized geographic sources of contamination within the former Rialto Ammunition Backup Storage Point (RABSP) in north Rialto being identified as the major currently known source of perchlorate contamination in the Rialto Colton Basin (**Figure 2**).

The RABSP operated during World War II as a storage and loading complex where a large portion of the munitions used in the Pacific theater of war were temporarily stored. After the war, the RABSP property was sold, resold, sub-divided and used, leased, or rented to numerous

commercial enterprises. Throughout this period and continuing to the present, many of the original bunkers and roads continued to be used for commercial/industrial purposes, with pre-existing RABSP roadways and munitions bunkers subsequently used for the manufacture, storage, transport, and disposal of rocket fuels, explosives, fireworks, and other potentially hazardous substances. Recognizing the association between historical RABSP activities and existing soil and groundwater contamination, the U.S. Environmental Protection Agency (USEPA), California Department of Toxic Substance Control (DTSC) and the California Regional Water Quality Control Board (RWQCB) have issued orders to potentially responsible parties (PRPs) to better characterize and remediate contamination on properties within, and adjacent to, the former RABSP. The PRPs represent more than 20 entities including: the Department of Defense, defense contractors, fireworks companies, a hazardous waste management facility, and other entities.

For the purposes of this White Paper, these two source areas are referred to as the "Bunker Area" (located near the central and southwestern portion of the RABSP) and the "160-Acre Parcel" (located near the northeastern portion of the RABSP). While some perchlorate impacts that originate near the "Bunker Area" portion of the RABSP have been well-documented in studies completed by the County, characterization of groundwater impacts from the "160-Acre Parcel" and within the remainder of the RCB are in their initial stages. As detailed herein, interception and control of impacted groundwater that originates in the former RABSP is considered a critical element for cleaning up the RCB.

3 PROJECT OVERVIEW

The water supply restoration and plume containment approach generally includes the following:

Water Supply Restoration – A wellhead treatment program is necessary to: 1) restore water supplies; 2) reduce the mass of perchlorate within the purveyors' service areas; and, 3) minimize the treatment times and costs for remediation. Wellhead treatment will include: 1) construction and five years of annual costs for new systems at wells which currently have detections of perchlorate and need treatment (where possible, treatment has been grouped for wells to minimize costs); and, 2) funding non-recovered capital costs, operations and maintenance (O&M) costs for existing treatment systems to date, and five years of annual costs for those systems.

Plume Containment– High concentrations of perchlorate have been identified in groundwater downgradient of the former RABSP. The County is currently implementing a plume interception and remediation program to partially address "Bunker Area" impacts. Based on data developed during preparation of the conceptual model and follow-on field characterization studies, a second plume interception program is needed to address impacts from the "160-Acre Parcel".

One aspect of plume interception is engineering design that must be conducted, which includes the following:

1. Developing a Scoping Document that complies with the National Contingency Plan (NCP) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).
2. Establishing a conceptual model that can serve as a basis for remedial design; and,
3. Designing a preliminary five-year remedy and characterization effort that promotes a quick response to existing and potential future groundwater contamination and provides data for successive remedies.

4 PROJECT WORK TASKS

The following sections provide a description of project tasks, sub-tasks and an estimate of the resources that are anticipated to be required to complete this work. It is intended that all aspects of this work will be performed in compliance with NCP and CERCLA guidelines. The cost estimate for this work, which totals $106,150,000, is shown in **Table 1** and is based on past investigation and remediation efforts in the RCB.

4.1 TASK 1 – WATER SUPPLY RESTORATION

Perchlorate removal by wellhead treatment systems is currently being performed on some wells to meet the immediate water supply needs of the community served by the four purveyors. While groundwater extraction at these wells is necessary to meet immediate water supply needs, there are other water supply wells in the region that are impacted by perchlorate whose reactivation (with water treatment) is critical. The goal of the wellhead treatment program is to stabilize the water purveyor operations, decrease the mass of contaminants in groundwater, reduce the time and resources required for aquifer restoration, and assure the continued ability of purveyors to meet the water supply needs of the community.

Although the focus of cleanup is the RCB, wellhead treatment includes purveyor wells outside of the RCB within the purveyors' service areas. This is necessary to provide operational flexibility and to mitigate perchlorate contamination throughout the basins. This White Paper includes: 1) an estimate to install 10 new systems to treat 12 currently impacted wells, or where possible, groups of wells; and, 2) eight existing treatment systems for 10 wells. This will restore water supplies for 22 wells, representing a combined capacity of more than 35,000 gallons per minute (gpm), of which 12 wells and 21,800 gpm are currently idle. Costs summarized herein represent known costs where possible, and estimated costs scaled for the required flow rates in gpm based on costs for existing systems.

4.1.1 Additional Wellhead Treatment Systems

Many of the groundwater purveyors are in need of additional wellhead treatment systems to meet community water supply demands. The cost estimates presented here will fund the capital cost of installing 10 new wellhead treatment systems on 12 wells. Expanded cost estimates and scaling assumptions are contained in **Table 2**.

Party	Well Designation	Flow Rate (gpm)	Estimated Capital Costs	Estimated 5 Year Annual Costs
City of Rialto	Rialto #1	2,000	$2,000,000	$2,400,000
	Rialto #2	2,000	$2,000,000	$2,400,000
	Rialto #4	2,200	$2,000,000	$2,640,000
	Rialto #6	2,150	$2,000,000	$2,580,000
FWC	F18A, F25A and F35A	5,000	$3,000,000	$6,000,000
	F3A	1,500	$1,500,000	$1,800,000
	F4A	1,500	$1,500,000	$1,800,000
WVWD	WVWD 22	1,500	$1,500,000	$1,800,000
	WVWD 37	1,650	$1,500,000	$1,980,000
	WVWD 41	2,300	$2,000,000	$2,760,000
TOTALS	10 Systems, 12 wells	21,800	$19,000,000	$26,160,000

The total cost for additional wellhead treatment systems is $45,160,000, the combination of the Estimated Capital Costs ($19,000,000) and the Estimated 5 Year Annual Costs ($26,160,000).

4.1.2 Existing Wellhead Treatment Systems

At this time, the water purveyors are operating eight perchlorate treatment systems to treat 10 wells. The costs listed below represent the unrecovered capital, unrecovered annual operating costs and estimated annual operating costs for these systems. Expanded cost estimates and scaling assumptions are contained in **Table 2**.

Party	Well Designation	Flow Rate (gpm)	Unrecovered Capital Cost	Unrecovered Annual Cost	Estimated 5 Year Annual Costs
City of Colton	Colton #17/#15	2,500	$224,000	$152,000	$3,000,000
	Colton #24	2,500	$170,000	$101,000	$3,000,000
City of Rialto	Chino Well #1	1,875	$170,000	$0	$2,250,000
	Chino Well #2	1,585	$276,000	$200,000	$1,902,000
City of Rialto/ County	Rialto Well #3	2,100	$2,000,000	$0	$3,000,000
FWC	F17B and F17C	5,000	$1,165,000	$350,000	$6,000,000
WVWD	WVWD 42	2,000	$0	$0	$2,400,000
	WVWD 18A	2,000	$0	$0	$2,400,000
TOTALS	8 Systems, 10 wells	19,260	$4,005,000	$803,000	$23,952,000

The total cost for existing wellhead treatment systems is $28,760,000, the combination of the Unrecovered Capital Costs ($4,005,000), the Unrecoveered Annual Costs ($803,000) and the Estimated 5 Year Annual Costs ($23,952,000).

4.2 TASK 2 – PLUME CONTAINMENT

The plume containment effort is conceptually focused on operation of two parallel remediation systems downgradient of the "Bunker Area" and the "160-Acre Parcel" in order to intercept higher concentrations of perchlorate and other contaminants before they spread further in groundwater. A plume containment strategy is currently being implemented by the County associated with contamination emanating from the "Bunker Area." A portion of this is contained in the wellhead treatment aspect of this White Paper, as replacement of Rialto Well #3 is part of that effort. Other aspects of the County's approach are discussed herein, as are all aspects of the plume containment approach for elevated levels of contamination emanating from the "160-Acre Parcel".

This section discusses three sub-tasks: 1) engineering design; 2) data collection and characterization; and, 3) plume containment efforts.

4.2.1 TASK 2.1: ENGINEERING DESIGN SUB-TASK

Engineering design is necessary to develop the details of the remedial strategy to intercept higher concentrations of perchlorate leaving the RABSP. The engineering design includes three primary components that are specifically directed at characterization and remedy selection for intercepting contamination: 1) project work scope documents; 2) conceptual model development; and 3) plume interception design. The components of engineering design will be performed concurrent with the data collection and characterization sub-task.

Work Scope Documents

A scoping document will be prepared by the RCBTC that broadly details the work to be performed for each of the project work scope elements. A sampling and analysis plan, health and safety plan, quality assurance plan and permitting agenda will be included as parts of the scoping document. A public participation plan will also be included in the scoping document to address the NCP/CERCLA public notification requirements together with a schedule that identifies how this will be accomplished. A preliminary draft, draft for circulation, and final version of the scoping document will be developed by the RCBTC. The circulation draft will be subject to public comment. All comments will be incorporated or addressed prior to finalization.

Conceptual Model

A conceptual model will be developed to guide data collection and selection of appropriate remedial actions. The conceptual model generally will attempt to incorporate both hydrogeologic and contaminant information and identify data gaps. Recommendations will be made regarding filling data gaps by characterization efforts outlined in Task 2.2. A report will be submitted that summarizes the results of the background data collection effort and presents

a preliminary conceptual model of groundwater conditions in the basins. The report will include working drawings, maps and cross sections, findings, conclusions, and recommendations for characterization to support the basin cleanup effort.

Plume Interception Design

Based on the conceptual model and information collected during the data collection phase discussed in Task 2.2, a design will be prepared to implement the plume containment strategy for contamination sourced from the "160-Acre Parcel". The County has already completed its design associated with the "Bunker Area" and is currently installing the first system. This process will be performed for the "160-Acre Parcel" and includes: development of remedial investigation and feasibility study documents, preparation of a remedial action plan, and preparation of detailed construction plans. One important aspect of this design will include analysis of options and development of plans to facilitate disposition of treated groundwater.

The estimated costs for this sub-task are illustrated in **Table 1**, where it has been assumed that the system for contamination from the "160 Acre Parcel" will require 50% more effort than the system being installed by the County.

4.2.2 TASK 2.2: DATA COLLECTION AND CHARACTERIZATION SUB-TASK

A data collection effort is necessary to support the process of cleaning up groundwater in the basins and to provide critical information for successive remedies. This program will be based on the conceptual model and design data from Task 2.1 and is anticipated to consist of three primary aspects: 1) providing recommendations related to soil and groundwater source-area remediation at, or immediately near, source areas; 2) collecting design information to control contaminant migration from the former RABSP property; and 3) expanding the downgradient hydrogeologic database to support optimal wellhead treatment and/or down-plume remediation. A brief description of each sub-task is given below:

Providing Recommendations for Source Area Remediation

The sources of the perchlorate contamination must be identified, characterized and effectively remediated by the Responsible Parties (RPs). However, source control efforts will involve close cooperation between the regulatory agencies to encourage source area investigations and implementation of soil and groundwater remedies including on the former RABSP site. It is essential to expeditiously characterize and remediate source contamination before it reaches groundwater, to prevent continued migration of contamination off-Site. This source site remediation will decrease overall costs and shorten regional groundwater cleanup times. The RCBTC will make recommendations regarding RP efforts to investigate and remediate source areas.

Data Collection for Design of Plume Control for Contamination Emanating From RABSP Area

The County is currently implementing a remediation program that is designed to capture contaminated groundwater that originates on properties on and adjacent to the former "Bunker

Area" of the RABSP. Data for the County's design effort has already been collected and costs for that process are included in **Table 1**. A relatively larger mass of contamination appears to be associated with the "160-Acre Parcel" area and, similar to the County's program, interception of the perchlorate contamination emanating from this area will be achieved using a network of groundwater extraction wells. Data must be collected to design this approach.

Regional Characterization and Analysis to Support Further Remedy Selection and Optimization

Beyond the need for specific characterization efforts associated with containment of contamination emanating from the RABSP, data must be integrated in a numerical groundwater model that will be prepared for the project. This conceptual model will support management of the plume containment systems, optimization of wellhead treatment systems and potential design of supplemental mitigation strategies down-gradient of the plume cutoff systems.

Estimated costs for the Data Collection and Characterization Subtasks in **Table 1** include costs associated with source-control oversight; expenditures for County remedial characterization and data collection for the "160-Acre" design and investigation downgradient of the plume containment strategy.

4.2.3 TASK 2.3: PLUME CONTAINMENT SUBTASK

A second plume interception and treatment system is envisioned in the area east of the County's system. Inasmuch as the mass of contamination from the "160-Acre Parcel" appears to be significantly larger than the plume that originates from the "Bunker Area", funding estimates for this work anticipate a system that is 50% larger than the system being installed by the County. Like the County's system, it is anticipated that the 160-Acre Parcel treatment system will remove perchlorate from groundwater and deliver the treated product to the community's potable water supply systems. Plume containment involves the ongoing operation of the two systems. The components of each system are discussed below.

"BUNKER AREA" TREATMENT SYSTEM

As discussed earlier in the wellhead treatment system, the system being installed by the County has a wellhead treatment component, but also involves the installation of a number of specific groundwater extraction wells. The efforts involved in installing those wells and associated infrastructure to extract and transport water to the treatment system is included in this sub-task while the treatment system is included in the wellhead treatment section. These costs are contained in **Table 1**.

"160-ACRE PARCEL" TREATMENT SYSTEM

Using the engineering design developed in Task 2.1 and building on data from Task 2.2, installation of the "160-Acre Parcel" treatment system is expected to involve the following:

- Acquisition of all necessary regulatory permits and compliance activities in accordance with California DHS 97-005;

- Process selection and detailed design of water treatment systems and associated appurtenances;
- Acquisition of land, easements, and rights of way; and,
- Construction of extraction wells, piping and water treatment systems.

Work to construct the "160-Acre Parcel" treatment system is expected to cost approximately 50% more than the system being installed by the County (excluding the cost of real estate) as detailed in **Table 1**. A summary of costs for the plume containment efforts is as follows:

Task	Description	Includes	Estimated Costs
2.1	Engineering Design	Work Plan, Conceptual Model and Plume Interception Design	$1,605,000
2.2	Data Collection/ Characterization	For Contamination from both Bunker Area and 160-Acre Areas	$9,375,000
2.3	Plume Containment	For County's Bunker Area System and New 160-Acre Area System	$21,250,000
		TOTALS	$32,230,000

4.3 Allocation of Funding

The parties request that the proposal "PROPOSED INITIAL 5-YEAR GROUNDWATER CLEANUP APPROACH RIALTO-COLTON AND NEIGHBORING BASINS, SAN BERNARDINO COUNTY, CALIFORNIA" be funded in its entirety. However, in the event that any funds are received in an amount less than the total amount requested, such funds will be divided equally between the parties, each party receiving 20% of the funds.